DOCUMENT RESUME

ED 472 836 CS 511 231

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TITLE	The Logic of Scientific Research.
PUB DATE	2002-02-06
NOTE	6p.; Paper presented at the U.S. Department of Education "Use of Scientifically Based Research in Education" Working Group Conference (Washington, DC, February 6, 2002).
AVAILABLE FROM	For full text: http://www.ed.gov/offices/OESE/esea/research/reyna-paper.html.
PUB TYPE	Opinion Papers (120) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	Educational Practices; *Educational Research; Research Methodology; Scientific Enterprise
IDENTIFIERS	Empirical Research; *No Child Left Behind Act 2001; Randomized Experiments

ABSTRACT

This paper considers the case for scientifically based research. The paper presents the case in concise outline form, providing a rationale; an analogy to medicine; strength of evidence argument; and thoughts about educational sciences. It asks and answers the questions What is EBE? (Evidence Based Education); and What is empirical evidence? In discussing scientifically based research, the paper considers questions of quality; relevance; levels of evidence; randomized trials (asking why randomization is critical); where the research dollars flow; what the United States Department of Education will do; and goals. (NKA)

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No Child Left Behind

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- OESE Home

Submitted Paper—The Logic of Scientific Research—Valerie F. Reyna

Scientifically Based Research

Rationale

Related documents
- Transcript

- Why scientific research?
  - Research is the only defensible foundation for educational practice.
- If not scientific evidence, then what?
  - Tradition
  - Superstition
  - Anecdote

Analogy to Mer' ine

- Traditions: Bleeding people.
  - Good intentions are not enough.
- Clinical trials are recent.
- Why isn't personal experience sufficient?
- Clinical trials: Only way to really be sure of what works. (Logic)
- Same rules apply to education: Brain surgery (NAS).

Strength of Evidence

- In the meantime, hierarchy of evidence.
  - Not all-or-none
  - Possibly true to probably true versus nothing (NCES example)
- Theory: Evidence-based
  - Knowing why and how something works
  - Key to generalization
  - Pitfalls of theory

Educational Sciences

- No conflict between science and values.
  - Some decisions made on values.
  - Evidence is necessary but not sufficient.
- Science with a human face.
- How do we support translation of research into practice?
  - Suggestions welcome.

What is EBE?

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- Best available empirical evidence in making decisions about how to deliver instruction
- Gaps in scientific evidence: Human judgment (bias and wisdom)

What is empirical evidence?

- Scientifically based research from fields such as psychology, sociology, economics, and neuroscience, and especially from research in educational settings
- Objective measures of performance used to compare, evaluate, and monitor progress

Scientifically Based Research

- Quality
  - Measures and Methods
  - Scientific merit (double helix)
- Relevance and Significance
  - Trivial
  - Number affected and severity
- Two criteria of NSF

Quality: Levels of evidence

- All evidence is **NOT** created equal
  - Randomized trial
  - Quasi-experiment, including before & after
  - Correlational study with statistical controls
  - Correlational study w/o statistical controls (class size, high expectations)
  - Case studies

Randomized Trials: The gold standard

- Claim about the effects of an educational intervention on outcomes
- Two or more conditions that differ in levels of exposure to the educational intervention
- Random assignment to conditions
- Tests for differences in outcomes

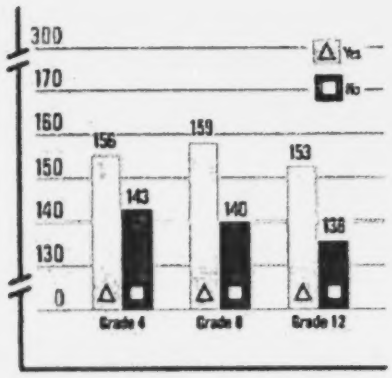
Why is randomization critical?

- Assures that the participants being compared have the same characteristics across the conditions
- Rules of chance mean that the smart, motivated, experienced, etc. have the same probability of being in condition 1 as in condition 2
- Without randomization, differences between two conditions may result from pre-existing difference in the participants, e.g., more smart ones in condition 1

Why is randomization critical?

Without randomization, simple associations such as between

Internet use and science grades have many different interpretations



Relevance

- Does the study involve a similar intervention and outcome to those of interest?
- Were the participants and settings representative of those of interest?
- Were enough participants involved to justify generalization? (statistical inference)

EBE: How to use existing science

- Search literature (Campbell Collaboration, PsychInfo, etc.)
- Screen literature
  - Relevance
  - Quality
- Search for pre-digested evidence
  - Narrative reviews (ERIC digests)
  - Systematic reviews (meta-analysis)

Screening research—Cautions

- Unconditional conclusions
- Conclusions involving hypotheticals
- Conclusions that diverge from evidence
- Strong calls to action
- Mixtures of opinions with evidence
- Low prestige publication outlet
- Publication outlet with ideological agenda

EBE: How to use objective measures

- Find or develop local data
  - measure and measure frequently
- Search state and national databases for benchmarks
  - www.edtrust.org
  - www.greatschools.net
  - www.ses.standardandpoors.com

  - www.just4kids.org
- Be skeptical

Evidence-Based Education—Where are we?

Where the Research Dollars Flow

- Of 84 program evaluations and studies planned by the Department of Education for fiscal year 2000, just one involved a randomized field trial
- 51 were a survey of need
- 49 had as their purpose program implementation/monitoring,
- 15 were non-randomized impact evaluations.
- Note: studies could have more than one purpose.
- Source: Robert Boruch, Dorthy de Moya, and Brooke Synder in Robert Boruch and Frederick Mosteller, eds., Evidence Matters (Brookings, 2001).

What ED will do

- The What Works Clearinghouse
  - Interventions linked to evidentiary support
  - Systematic reviews
  - Standards for & providers of evaluations
- Preschool Curriculum Evaluation Research
- Explanatory Research: Why and How
- Funding for evaluations of promising innovations in the field
- Build capacity internally and externally

Goals

- ED will provide the tools, information, research, and training to support the development of evidence-based education
- Education across the nation will be continuously improved
- Wide variation in performance across schools and classrooms will be eliminated

The practice of evidence-based education will become routine

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This page last modified—April 2, 2002 (pjk).

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